

LIQUID CRYSTAL DISPLAY

This application claims the benefit of Taiwan application Serial No. 092127521, filed October 03, 2003, the subject matter of which is incorporated herein by reference.

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BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The invention relates in general to a liquid crystal display, and more particularly to a liquid crystal display, of which the light source can be easily changed.

10 Description of the Related Art

[0002] Liquid crystal displays (LCDs) are widely applied in various electrical products such as personal digital assistants (PDAs), notebook computers, digital cameras, digital camcorders, mobile telephones, computer monitors, liquid crystal televisions, and the like because the technology for
15 manufacturing the LCDs is rapidly developed and the LCDs have the advantages of being light, thin, power-saving and radiation-free. However, because the LCD panel is a panel that cannot emit light rays itself, a backlight module is needed to provide light rays and to achieve the display function.

[0003] FIG. 1 is a schematic view of a conventional LCD. Referring first

to FIG. 1, a liquid crystal display (LCD) 100 at least includes a front bezel 110, a LCD panel 111 and a direct backlight module 120. The backlight module 120 includes a frame 130, a multilayer optical film 112, a diffuser plate 113, a lamp holder 115 and several light sources 114. The light sources 114 are
5 several parallel cold cathode fluorescent lamps (CCFLs) disposed within the lamp holder 115. The multilayer optical film 112 may include a diffusing sheet and a prism sheet.

[0004] The cold cathode fluorescent lamps have limited life-time. When the performance of the cold cathode fluorescent lamps 114 deteriorates, they
10 have to be changed to provide sufficient light or luminance to the liquid crystal display 100. The conventional process of changing the light sources 114 is as follows. The front bezel 110 is taken out after the front bezel 110 and the frame 130 are separated apart. Then, the LCD panel 111, the frame 130, the multilayer optical film 112 and the diffuser plate 113 are removed sequentially.
15 Next, the deteriorated light sources 114 are changed. All components of the liquid crystal display 100 can be re-assembled by the reversed procedure.

[0005] However, the changing procedure of the conventional liquid crystal display 100 is time-consuming. It includes complex steps of separating the front bezel 110 and the frame 130, and sequentially moving the front bezel 110,
20 the LCD panel 111, the frame 130, the multilayer optical film 112 and the diffuser plate 113.

[0006] Another disadvantage of the conventional liquid crystal display 100

is that the LCD panel 111, the multilayer optical film 112 and the diffuser plate 113 may hit and scrape each other during the process of changing the light sources 114.

SUMMARY OF THE INVENTION

5 [0007] In view of the foregoing, it is an object of the present invention to provide a liquid crystal display enabling users to directly change the light source with great convenience and the damage of the LCD panel, the multilayer optical film and the diffuser plate caused by hitting and scratching during the changing process can be prevented.

10 [0008] An object of the present invention is to provide a liquid crystal display including a front bezel, a frame and a diffuser plate. The front bezel has a first fastened member and the diffuser plate has a second fastened member. The frame is deposited below the front bezel and the diffuser plate is deposited below the frame. The frame has a first fastening member with
15 respect to the first fastened member and a second fastening member with respect to the second fastened member. The first fastening member and the second fastening member are respectively coupled with the first fastened member and with the second fastened member simultaneously so that the front bezel, the frame and the diffuser plate are integrated as a whole.

20 [0009] Another object of the present invention is to provide a liquid crystal display including a front bezel, a frame, a diffuser plate, a panel and a

multilayer optical film. The front bezel has a bottom surface, a side surface and a first fastened member. The side surface of the front bezel is perpendicular to the bottom surface of the front bezel and the first fastened member is formed in the side surface of the front bezel. The frame is deposited below the front bezel and has an upper surface, a bottom surface and a side extending section. The side extending section is perpendicular to the bottom surface. The first fastening member is disposed on the side extending section of the frame, and the second fastening member is disposed on the bottom surface of the frame. The diffuser plate is deposited below the frame and has an upper surface and a second fastened member. The second fastened member is formed in the upper surface of the diffuser plate. The panel is disposed between the front bezel and the frame, and the multilayer optical film is disposed between the frame and the diffuser plate. The upper surface of the frame is opposite to the bottom surface of the front bezel and the bottom surface of the frame is oppose to the upper surface of the diffuser plate. The frame further includes an exterior edge and an interior edge. The first fastening member is disposed on the exterior edge of the frame and the second fastening member is disposed on the interior edge of the frame. The first fastening member and the second fastening member are respectively coupled with the first fastened member and with the second fastened member simultaneously so that the front bezel, the panel, the frame, the multilayer optical film and the diffuser plate are integrated as a whole.

[0010] Other objects, features, and advantages of the invention will

become apparent from the following detailed description of the preferred but non-limiting embodiments. The following description is made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

5 [0011] FIG. 1 is a schematic view of a conventional LCD;

[0012] FIG. 2 is a schematic view of a LCD according to a preferred embodiment of the invention;

[0013] FIG. 3 shows the inverted frame in FIG. 2 when the frame is engaged with the diffuser plate; and

10 [0014] FIG. 4 is an enlarged view of the identified part A in FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

[0015] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred
15 embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like

components throughout.

[0016] FIG. 2 is a schematic view of a LCD according to a preferred embodiment of the invention. Referring first to FIG. 2, a liquid crystal display 200 at least includes a front bezel 210, a panel 211 and a direct backlight module 220. The backlight module 220 includes a frame 230, a multilayer optical film 212 and a diffuser plate 213, light sources 214 and a lamp holder 215. The panel 211 is a LCD panel and the light sources 214 are preferably several parallel cold cathode fluorescent lamps (CCFLs) disposed within the lamp holder 215. The multilayer optical film 212 preferably includes a diffusing sheet and a prism sheet.

[0017] The frame 230 is removably disposed between the front bezel 210 and the diffuser plate 213. The panel 211 is disposed between the front bezel 210 and the frame 230, and the multilayer optical film 212 is disposed between the frame 230 and the diffuser plate 213. Light emitted from the light sources 214 is diffused by the diffuser plate 213 and is filtered through the multilayer optical film 212 to reach and penetrate the panel 211. Then, the image is visible.

[0018] The front bezel 210 has a bottom surface 210b, a side surface 210c and a first fastened member 2108. The side surface of the front bezel 210c is perpendicular to the bottom surface of the front bezel 210b and the first fastened member 2108 is formed in the side surface of the front bezel 210c. The first fastened member 2108 is preferably a notch in the side surface of the

front bezel 210c.

[0019] The frame 230 has an upper surface 230a, a bottom surface 230b, a side extending section 230c, a first fastening member 2308 and a second fastening member 2309. The upper surface of the frame 230a is opposite to the bottom surface of the front bezel 210b so that the frame 230 is deposited below the front bezel 210. The side extending section of the frame 230c is perpendicular to the bottom surface of the frame 230b. The first fastening member 2308 is disposed on the side extending section of the frame 230c and is opposite to the first fastened member 2108 of the first bezel 210. The second fastening member 2309 is disposed on the bottom surface of the frame 230b. The first fastening member 2308 and the second fastening member 2309 are preferably a hook in the side extending section of the frame 230c and a hook in the bottom surface of the frame 230b, respectively.

[0020] The diffuser plate 213 has an upper surface 213a and a second fastened member 2139. The upper surface of the diffuser plate 213a is opposite to the bottom surface of the frame 230b so that the diffuser plate 213 is deposited below the frame 230. The second fastened member 2139 is formed in the upper surface of the diffuser plate 213a and is opposite to the second fastening member 2309 of the frame. The second fastened member 2139 is preferably a notch in the upper surface of the diffuser plate 213a.

[0021] Both referring to FIG.3 and FIG. 4, FIG. 3 shows the inverted frame in FIG. 2 when the frame is engaged with the diffuser plate, and FIG. 4 is an

enlarged view of the identified part A in FIG. 3. The frame 230 further includes an exterior edge 230d and an interior edge 230e. The first fastening member 2308 is disposed on the exterior edge 230d of the frame 230 and the second fastening member 2309 is disposed on the interior edge 230e of the frame 230. The first fastening member 2308 and the second fastening member 2309 can be respectively coupled with the first fastened member 2108 and with the second fastened member 2139 simultaneously so that the front bezel 210, the panel 211, the frame 230, the multilayer optical film 212 and the diffuser plate 213 are integrated as a whole.

[0022] The assembling process of the liquid crystal display 200 is performed as follows. Firstly, take the frame 230 of the backlight module 220 as the principle part of the liquid crystal display 200, and then the frame 230 and the diffuser plate 213 are fastened together after the multilayer optical film 212 is disposed therebetween. Secondly, the front bezel 210 and the frame 230 are fastened together after the panel 211 is disposed therebetween. Finally, the whole of the front bezel 210, the panel 211, the frame 230, the multilayer optical film 212 and the diffuser plate 213 is connected with the lamp holder 215 where the light sources 214 are disposed. As a result, the liquid crystal display 200 is completely assembled.

[0023] One of the characteristics of the invention is that the front bezel 210, the panel 211, the frame 230, the multilayer optical film 212 and the diffuser plate 213 can be integrated as a whole as a result of the combination of first fastening member 2308 with respect to the first fastened member 2108 and

the second fastening member 2309 with respect to the second fastened member 2139, simultaneously. That allows users to directly change the light sources 214 with great convenience by simply taking out the whole of the front bezel 210, the panel 211, the frame 230, the multilayer optical film 212 and the diffuser plate 213. Thus, the processing time can be reduced.

[0024] Also, the panel 211 is disposed between the front bezel 210 and the frame 230 when the first fastening member 2308 is buckled with the first fastened member 2108. The multilayer optical film 212 is disposed between the frame 230 and the diffuser plate 213 when the second fastening member 2309 is buckled with the second fastened member 2139. By this, the damage of the panel 211, the multilayer optical film 212 and the diffuser plate 213 caused by hitting and scratching during the changing process, which occurs in the conventional Liquid crystal display 100, is prevented.

[0025] Further, the material of the frame 230 is preferably plastic (PC), and the frame 230 is preferably manufactured by mechanical shooting. The first fastened member 2108 and the second fastened member 2139 are preferably notches, and the first fastening member 2308 and the second fastening member 2309 are preferably hooks. Hooks can be inserted into notches and be fastened, so that the first fastening member 2308 and the second fastening member 2309 can be fastened with the first fastened member 2108 and the second fastened member 2139, respectively. In addition, the first fastening member 2308 and the second fastening member 2309 can be removably disposed in the frame 230 and slide movably thereon rather than

above-mentioned fixed ones.

[0026] However, the present inventions are not limited in what are described above. It will be understood to one skilled in the art that various coupling means can be applied to couple the front bezel 210, the frame 230 and the diffuser plate 213. For example, the first fastened member 2108 can be disposed on the side surface of the front bezel 210b. The diffuser plate 213 can have a side section or a side extending section, and the second fastened member 2139 can be disposed therein. Moreover, the first fastening member 2308 and the second fastening member 2309 can be respectively disposed on the upper surface of the frame 230a and the bottom surface of the frame 230c, instead of being disposed on the exterior edge 230d and the interior edge 230e of the frame 230 in the preferred embodiment of the invention.

[0027] While the invention has been described by way of example and in terms of a preferred embodiment, it is to be understood that the invention is not limited thereto. On the contrary, it is intended to cover various modifications and similar arrangements and procedures, and the scope of the appended claims therefore should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements and procedures.